REMARKS

Claims 1-9 and 13-15 are pending in the application. Claims 1 and 13 are in independent form. Favorable reconsideration is requested.

Reconsideration is respectfully requested of the rejection of Claims 1-9 and 13-15 under 35 U.S.C. §103(a), as being unpatentable over U.S. Patent No. 5,704,024 ("*Voorhies*") in view of U.S. Patent Publication No. 2003/0112238 ("*Cerny*").

Regarding paragraph 3 of the Office Action ("Response to Arguments" section), the Examiner states that the first and last lines of Claim 1 are disclosed by *Voorhies,* citing particular passages therefrom. Applicant respectfully disagrees, for the reasons explained below.

Regarding the first line of Claim 1, this concerns '*forming a two dimensional map of a three dimensional environment*' (i.e. generating an environment map). By contrast, Column 9 lines 24 to 27 *Voorhies*, cited for this feature, states that '*the present invention provides a method ... for generating reflection vectors which can be unnormalized (i.e. have non-unit lengths) and for using these reflection vectors to index locations on an environment map*'.

Thus a plain reading of this passage teaches that *Voorhies* is generating a new type of reflection vector, and not a new type of environment map.

This can be readily seen from figures 3 and 6 and column 10 lines 45-64 of *Voorhies*; as can be seen in figure 6, *Voorhies* uses a conventional cube mapping arrangement, where six two-dimensional environment maps are positioned around the object so as to cover all possible angles of reflection. This is the 'three dimensional environment map' of *Voorhies*.

For clarity, at this point we highlight the clear distinction between an actual three dimensional environment and an environment map **of** that three dimensional environment. It will be easily appreciated that such a 'three dimensional environment map' is not the actual

three-dimensional environment itself, but a specific representation of it used for the computationally efficient generation of reflections in an object that looks as if they have come from the actual three-dimensional environment. We also note that the presently claimed invention makes this distinction between a map and an environment in Claim 1, which reads '…forming a two dimensional map of a three dimensional environment…'.

As is seen in figure 3 and the above text of column 10 of *Voorhies*, for a given point on the object being rendered, a reflection vector is computed and the appropriate one of the six environment texture maps that this vector hits is identified (column 10 line 50). The exact position on this map where the vector hits identifies (indexes) the texture pixel recalled for use in rendering the apparent reflection of the environment at that point on the object (column 10 lines 57 to 64).

As such, the rendering process in *Voorhies* is entirely conventional, in that it computes reflection vectors and retrieves texture information from where that reflection vector points to on an environment map. Rather, *Voorhies* is concerned with simplifying computation of the reflection vectors themselves (i.e. not normalizing them).

Regarding the last line of Claim 1, this concerns '*deriving by the computer properties for a map position from the properties of the corresponding environment position*'. Thus this line therefore requires:

i. an environment position;

ii. a map position corresponding to it; and

iii. deriving a property for that map position from the corresponding environment position (e.g. deriving a texture pixel color).

The Examiner cites column 12 lines 24-31 of *Voorhies*, and explicitly states that reflection vectors (from the object being rendered) are used to identify a location on an environment map and retrieve the appropriate shading value from the map. Thus, the Examiner's own reading of *Voorhies* demonstrates a conventional retrieval of texture data from a map at the appropriate reflection point. However, it clearly does not demonstrate deriving initial data for the map (which *Voorhies* then retrieves), and moreover does not mention deriving such data from a corresponding position in the original environment.

Thus the above passages of *Voorhies* cited by the Examiner refer merely to the conventional *use* of environment maps, and not in any way their generation. By contrast, **at column 11 lines 50 to 63, *Voorhies* explicitly teaches the entirely conventional generation of two dimensional environment maps**. This is the full extent of disclosure in *Voorhies* of generating such maps.

With respect to the presently claimed invention, the above described generation of two-dimensional environment maps in *Voorhies* does **not** teach or suggest the following features found in Claim 1:

i. a plane containing both a viewing direction vector and an environment position (i.e. the position currently under analysis) – see plane 1800 of figure 13 and the accompanying text of the present application for details;

ii. associating with that environment position a folded vector lying within the above plane – see figure 11 and the accompanying text of the present application for details;

iii. the folded vector having an angle that is a function of the angle between the viewing direction vector and a vector between the map origin and the environment position – for details, see the equation at page 15 line 25 of the description, which halves the angle

between the viewing direction vector and a vector between the map origin and the environment position within the above plane;

iv. associating the environment position with the map position corresponding to the folded vector –see figure 15 and page 16 lines 10 to 24, where projection plane 1850 represents the surface of the map being generated; and

v. deriving a property for that map position (based on the folded vector) from the corresponding environment position – see again figure 15 and page 16 lines 10 to 24 for details.

For completeness, we further respond to paragraph 5 of the Office Action. The Examiner will at this point appreciate our position that *Voorhies* in fact explicitly discloses conventional environment map generation at column 11 lines 50 to 63, and that other cited passages of *Voorhies* are not further concerned with this process.

Furthermore, we also again point out that an environment map is not the environment itself but a particular and separate representation of that environment; moreover we note that *Voorhies* itself makes this distinction at column 11 lines 50-51 and column 11 lines 55-58.

To avoid any doubt with respect to the above, we also note that Claim 1 clearly makes the same distinction between environmental maps and the environment itself, where it recites 'forming a two dimensional map of a three dimensional environment'. It is respectfully submitted that **it does not make technical sense** to equate the three dimensional environment of Claim 1 with maps of a three dimensional environment from *Voorhies*, and in addition it is inconsistent with the teaching of *Voorhies* as outlined above. Hence it also does not make technical sense to apply passages relating to the recall of data from such maps with a claim to the

generation of such maps. We sincerely hope that the aforementioned discussion will set aside this clear misunderstanding.

In paragraph 5 of the Office Action, the Examiner argues that *Voorhies* is concerned with generating map properties of a 3D environment, based on column 11 lines 29-33. However as we have already noted above, it should be clearly understood that a '3D environment map' is for example a cubic arrangement of six environment maps that themselves represent the actual 3D environment, but therefore clearly are not the 3D environment itself. The cited passage clearly relates to locating values in a 3D environment map. It therefore clearly does not teach or suggest generating properties *for* a map *from* a 3D environment.

Similarly referring to paragraph 7 of the Office Action, the Examiner argues that multiplier 1525 is a predetermined function relating the folded vector to other quantities. However, ***Voorhies* does not have a folded vector** as claimed. Nowhere in *Voorhies* is a folded vector disclosed with the claimed property of having an angle that is a function of an angle between the viewing direction vector and a vector between a map origin and an environment position; firstly, there are no vectors between the map origin and the environment position because in the cited passage Voorhies is using existing environment maps, not the environment itself, as made clear above; secondly there is no plane disclosed containing both a viewing direction vector and an environment position; and thirdly, there is no disclosure of a folding vector lying within that plane. As a result there is no disclosure of the relationship of such a folding vector in such a plane with such other vectors and environment positions.

By contrast, it is clear from figure 12 of *Voorhies* that multiplier 1525 is applied to reflection vectors between the object and an existing environment map for the purpose of selecting a position on that map.

In this regard we respectfully make the more general observation that throughout the Office Action there appears to be a consistent equivalence given between *generating* properties of an environment map (as in the present invention) and *locating* properties of an existing environment map (as in *Voorhies*). We hope that the above arguments clarify that these are not equivalent actions.

In conclusion, we therefore submit that *Voorhies* is concerned with a method of using unnormalized reflection vectors during use of a cubic reflection mapping, and discloses purely conventional methods of generating the environment maps used for such cubic reflection mapping. *Voorhies* fails to teach or suggest, with respect to generating environment maps, at least the aforementioned five features of Claim 1.

We therefore submit that Voorhies does not teach or suggest Claim 1 (and likewise corresponding apparatus claim 13).

Referring now to paragraph 10 of the Office Action regarding *Cerny*, the Examiner argues that paragraph [0030] of *Cerny* discloses generating an environment map. Applicant disagrees. *Cerny* is in fact concerned with a slightly different type of environment mapping than *Voorhies* (and the present invention), being concerned with the illumination of objects by virtual light sources, rather than with the reflection of an environment by an object (see paragraph [0005]) of *Cerny*). As a result ***Cerny* does not require an environment map** representing the (non-existent) environment as the environment is not reflected.

Rather, as is clear from paragraph [0007] of *Cerny*, a texture map for application to the object itself is being generated based upon how virtual lights illuminate the object.

It will be readily appreciated that a texture map of an object is fundamentally different to a two dimensional environment texture map for an environment surrounding the object and which is used to compute how that environment is reflected by the object.

Reading paragraph [0030] in light of paragraph [0007], it is clear that paragraph [0030] relates to generating the texture on the object and is not relevant to the presently claimed invention.

We also respectfully assert that neither paragraph [0030] or any other part of *Cerny* teaches or suggests the aforementioned five features of Claim 1.

We therefore submit that *Cerny* does not teach or suggest Claim 1 (and likewise corresponding apparatus claim 13).

Accordingly, it is respectfully submitted that independent Claims 1 and 13, and the claims depending therefrom, are patentably distinct over *Voorhies* and *Cerny*, alone or in any possible combination, if any.

In view of the remarks set forth above, this application is believed to be in condition for allowance which action is respectfully requested. However, if for any reason the Examiner should consider this application not to be in condition for allowance, the Examiner is respectfully requested to telephone the undersigned attorney at the number listed below prior to issuing a further Action.

Any fee due with this paper may be charged to Deposit Account No. 50-1290.

Favorable reconsideration is earnestly solicited.

Respectfully submitted,

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